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HEALTH EVALUATION

BROWN'S DUMP SITE
4330 PEARCE STREET
JACKSONVILLE, FLORIDA



EMCON

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Prepared for

City of Jacksonville Solid Waste Division
515 North Laura Street, 6th Floor

Jacksonville, Florida 32202

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Prepared by

EMCON
Crossroads Corporate Center
One International Blvd., Suite 700
Mahwah, New Jersey 07495

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Health Evaluation

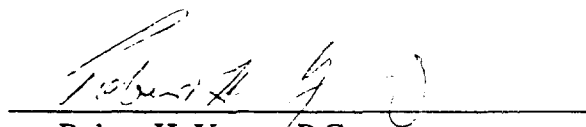
**Brown's Dump Site
4330 Pearce Street
Jacksonville, Florida**

The material and data in this report were prepared under the supervision and direction of the undersigned.

EMCON



Tamara L. Sorell, PhD
Senior Toxicologist



Robert H. Young, P.G.
Project Manager
Florida Reg. No. 123

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1 INTRODUCTION

The Brown's Dump Site in Jacksonville, Florida, has been the subject of a contaminant assessment pursuant to Florida Department of Environmental Protection (FDEP) guidelines for "Corrective Actions for Contamination Site Cases." As part of this process, EMCON (1995a,b) completed, on behalf of the Duval County School Board, JEA and the City of Jacksonville Solid Waste Division, a Contamination Assessment Plan (CAP) and Contamination Assessment Report (CAR) to evaluate the nature and extent of contamination at the site. The CAR was submitted to the FDEP in November 1995. Additional evaluations and submittals were performed in 1996.

The CAR concluded that a health risk evaluation for the site was necessary. Accordingly, this baseline health evaluation was performed for the City of Jacksonville Solid Waste Division to evaluate the current and potential future health impacts associated with the site (limited to contaminants tested for) in its current condition. The conclusions regarding health impacts will be used to assist in the development of appropriate corrective action for the site.

2 PROJECT HISTORY

2.1 Site Description

For the purposes of the health evaluation, the site consists of the Mary McLeod Bethune Elementary School, the adjacent Jacksonville Electric Authority (JEA) substation, and the surrounding residential area. The site location and general site area are shown on Figures 1 and 2, respectively. The site is characterized by its former use as a landfill, primarily to deposit ash from the City of Jacksonville municipal solid waste (MSW) incinerator. Ash is present at depths ranging from the surface to 22 feet below ground surface. Although the ash varies in color, it is readily identified by the presence of glass and metal fragments. It is generally several inches to several feet in thickness across the site.

Ash has been estimated to cover approximately 50 acres. The school property occupies approximately 14 acres, with the JEA substation to the northeast occupying about 2 acres. The surrounding area is primarily residential. The nearest residences to the school are the Bessie Circle cul-de-sac apartments located immediately west of the school property. The majority of the residences consist of single-family homes on approximately 0.1 acre lots.

Much of school property is covered by grass, pavement, or three school buildings. The teachers' parking lot on the eastern portion of the school property along Pearce Street is unpaved, and ash predominates at the surface. The playground area to the west of the buildings is intended to be grass-covered, but the grass is absent or dead in many places. Therefore, as part of Phase I of interim measures, six inches of top soil was placed in these areas. The soil was seeded, but does not support a grass cover.

The homes in the area are generally well tended. All the streets are paved. Right-of-ways are grass-covered. Grass cover also exists in most of the yards. Some property areas, especially those used for parking, are covered with gravel. Ash is visible at the surface in a few locations.

Moncrief Creek borders the school property along its northwestern boundary. The creek is a Class III surface water; uses corresponding to this classification are recreation and the maintenance and propagation of fish populations. The creek is perennial, and small fish are present.

Fencing exists along the portions of the creek abutting JEA property and residential areas, but is damaged. The creek banks in the area along school and residential property appear to be composed of ash, which is surficial and apparently erodible. Footpaths, damaged fencing and litter are evidence of ready creek access. Domestic dogs were observed sleeping on the southern bank adjacent to the residential area.

2.2 Database

Several investigations have been performed at the site to define the extent of ash and characterize environmental media contamination. A Contamination Assessment Report was completed in 1995 (EMCON, 1995a). The scope of work included the installation of 62 soil borings and eight shallow monitoring wells, surface water and sediment sampling, and groundwater sampling. A well inventory in the area was also performed. Based on the results of this investigation, follow-up work was completed in 1996 that included the installation of additional soil borings on school property and in the surrounding residential areas to define the lateral extent of ash. Selected samples were also analyzed for total lead and Toxicity Characteristic Leaching Procedure (TCLP) lead.

The overall findings of these investigations were as follows:

- Ash contains elevated lead concentrations compared with soil, generally in the 1000 to 2000 milligrams per kilogram (mg/kg) range, but up to several thousand mg/kg in some locations; two samples collected in one location contained 78,800 and 43,400 mg/kg. Other inorganic elements were not markedly elevated in ash compared with soil. Arsenic was only detected in one ash sample.
- With the exception of the two soil samples containing maximum lead concentrations, samples do not contain leachable lead (or other metals) above TCLP limits.
- Soil samples above and below the ash layer contain lead below 500 mg/kg.
- Shallow groundwater does not contain priority pollutants and cyanide. Inorganics were not detected above Florida Primary Drinking Water Standards.
- There are no operating permitted groundwater supply wells within a 0.5 mile radius of the school.
- Surface water and sediment in Moncrief Creek are not contaminated with inorganics.

Based on these findings, lead is the chemical of concern at this site. As discussed in Section 5, the primary health concern associated with exposure to lead is behavioral and cognitive impacts to children. Levels of lead in blood have been shown to be correlated with health impacts. Therefore, to assess the extent of exposure to lead, the Duval County Public Health Unit of the Florida Department of Health and Rehabilitative Services (HRS) analyzed blood lead (BPb) levels from 130 Kindergarten and pre-Kindergarten students at the Mary McLeod Bethune Elementary School and surrounding neighborhood in 1995. Six children showed BPbs considered to be elevated (in the 10-15 micrograms per deciliter [$\mu\text{g}/\text{dl}$] range). This rate (4.6%) was lower than for the inner city Jacksonville overall in 1994 (8.9%). The HRS concluded that children in the site area do not appear to be at any increased risk compared with children in comparable areas. Epidemiologic surveillance of the area is ongoing.

3 HEALTH EVALUATION APPROACH

Human health risk assessments generally follow a specific procedure described in USEPA guidance (Risk Assessment Guidance for Superfund [RAGS], USEPA, 1989b). The steps involved are:

- Data evaluation
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

The data evaluation step summarizes the database, confirms that it is relevant and sufficient for performing the assessment, and identifies the chemicals of concern (COCs) to evaluate in the RA. In the exposure assessment, the receptors and complete exposure pathways are identified. A receptor is an individual who could potentially come into contact with contaminated media and thereby be exposed to the chemicals of concern. Pathways are mechanisms by which intake could occur, such as water ingestion or dust inhalation. Exposure is estimated for each pathway and is expressed in milligrams intake per kilogram body weight per day (mg/kg-day).

The toxicity assessment presents the toxicity factors (TFs) for the COCs. Toxicity factors are values developed by USEPA that either express the dose-response relationship between exposure and carcinogenicity (slope factors) or represent safe (not-to-exceed) daily doses for noncancer effects (reference doses). In the risk characterization, two separate sets of calculations are generally performed using the TFs and the exposure estimates. The lifetime excess risk of cancer is estimated by multiplying the estimated intake by the carcinogenic slope factor. The degree of noncarcinogenic hazard is calculated as a ratio between site intake and the reference dose.

The typical risk assessment methodology cannot be strictly applied to the Brown's Dump site because the contaminant of concern is lead. Although lead is classified by USEPA as a B2 carcinogen (probable human carcinogen), no slope factor has been developed. Furthermore, EPA considers the development of a reference dose for lead to be "inappropriate" (USEPA, 1996a). The major reason USEPA cites for the absence of these factors is the acknowledged complexity of lead exposure and effects. Estimating

lead risk using standard RAGS methods and calculations could therefore result in misleading conclusions.

For these reasons, the possible hazards associated with lead exposure cannot be characterized using the standard risk assessment equations. Because of lead's documented hazards, however, a reliable method of assessing exposure has been developed. Blood lead (BPb) concentration is routinely used in the scientific and medical community as an indicator of recent lead exposure, and therefore of potential hazard. BPb is correlated with recent internal lead exposure (i.e., absorbed lead). Concentrations have been shown to be independent of route of entry (Woernle *et al.*, 1991). Since the half-life of lead in blood is 28 to 36 days, BPb is most representative of recent exposure. Although USEPA lists lead as a B2 carcinogen, only noncancer effects have been quantitatively related to BPb. Therefore, consistent with current practices, this assessment only evaluates hazards associated with noncancer effects of lead. These effects likely occur at lead levels lower than those leading to cancer, so the assessment focuses on the most sensitive endpoint of lead toxicity.

Because BPb is such an important indicator of lead hazard, USEPA has developed a model for estimating BPb in children resulting from exposure to various environmental sources of lead. The Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK; USEPA, 1994c) is intended as a predictive tool in cases where actual BPbs are not available (1994a). In the case of Brown's Dump, modeling is not necessary, as a BPb database exists.

A number of studies have been done evaluating the relationship between environmental sources of lead and BPbs. Most have focused on pre-school children (between the ages of 9 and 71 months) who have been shown to be most sensitive to lead and its behavioral and developmental effects. Young children have higher lead exposure than adults because of greater hand-to-mouth behavior and the potential for pica (Gaventa *et al.*, 1992). Children also absorb and retain more lead than adults do on a unit-mass basis (Woernle *et al.*, 1991). The best currently available approach for evaluating exposure and hazard associated with lead is therefore to assess BPbs in children and evaluate possible hazards associated with BPb levels using information in the literature.

The exposure assessment (Section 4) identifies the potential receptors and complete pathways of lead exposure. This evaluation also summarizes the relevant findings from the literature that relate environmental concentrations to BPb. The toxicity assessment (Section 5) assesses the levels of exposure that are associated with lead hazards. Finally, the risk characterization (Section 6) provides an overall evaluation of the degree of lead hazards to the site receptors.

4 EXPOSURE ASSESSMENT

4.1 Pathway Evaluation

As previously discussed, small children have been shown to be the receptor most sensitive to the effects of lead. Therefore, the target receptor for the Brown's Dump site is assumed to be a preschooler living in the area or a child of elementary school age living in the area and attending the Mary McLeod Bethune Elementary School. This likely represents the maximally exposed individual at the site. Complete pathways related to the identified soil contamination with ash and likely to contribute most significantly to blood lead levels are:

- Incidental ingestion of ash
- Consumption of produce grown in ash-contaminated soil
- Inhalation of ash suspended as fugitive dust

An additional environmental pathway of concern for lead unrelated to ash is ingestion of lead-based paint in the home. Given the typical age of the residences in the site area, which predates the elimination of lead-based paints and the large body of knowledge related to lead toxicity, this pathway would be expected to contribute a significant proportion of observed lead body burden.

Incidental soil ingestion is a pathway of concern. USEPA uses 200 mg (0.2 g) as a typical daily soil/dust ingestion rate for children. Assuming a typical on-site soil (ash) concentration of 2000 mg/kg (equivalent to $\mu\text{g/g}$), daily lead intake would be estimated at:

$$\text{Daily Intake} = 2000 \frac{\mu\text{g Pb}}{\text{g soil}} \times 0.2 \frac{\text{g}}{\text{day}} = 400 \frac{\mu\text{g Pb}}{\text{day}}$$

Consumption of produce grown in lead-contaminated soil (ash) is likely to be a pathway of minor concern. Plant uptake factors from soil to a variety of food crops have been reported to range from 0.0008 to 0.01, with most crops in the 0.002 to 0.005 range. (MADEP, 1992). This means that concentrations are generally 100 to 1250 times lower in the fruit or vegetable than in the soil. Given the low apparent bioavailability of lead in

ash, probably due to its low solubility (Section 6), plant uptake of lead from ash is likely to be even lower than from soil. Furthermore, home gardening in the site area appears to be uncommon, probably due to the small lot sizes.

However, the potential for exposure through this pathway remains. Assuming an overall conservative uptake factor of 0.005 and an ash lead concentration of 2000 mg/kg, the plant concentration would be:

$$\text{Vegetable Conc.} = 2000 \frac{\text{mg Pb}}{\text{kg ash}} \times 0.005 \frac{\text{kg ash}}{\text{kg veg.}} = 10 \frac{\text{mg Pb}}{\text{kg veg.}} = 10 \frac{\mu\text{g Pb}}{\text{g veg.}}$$

The USEPA estimate of the median consumption rate of homegrown produce for an urban southern U.S.A. dweller is 2.55 g/kg body weight per day (USEPA, 1995). Based on a body weight of 15 kg for a child (USEPA, 1991), the daily intake would be:

$$\text{Daily Intake} = 10 \frac{\mu\text{g Pb}}{\text{g veg.}} \times 2.55 \frac{\text{g veg.}}{\text{kg} \cdot \text{day}} \times 15 \text{ kg} = 382.5 \frac{\mu\text{g Pb}}{\text{day}}$$

It is difficult to estimate the extent to which inhalation contributes to overall lead intake at the Brown's Dump site. It has been estimated that blood lead increases by approximately 2 µg/dl for every increase of 1 microgram per cubic meter (µg/m³) in air lead (Angle *et al.*, 1984). USEPA derived a pooled weighted estimate of 1.64 µg/dl BPb increase per each 1 µg/m³ air concentration increase (USEPA, 1990). Any air exposure related to ash would be the result of fugitive dust suspension. Because soil, dust and air lead concentrations are highly correlated (Angle *et al.*, 1984), it is difficult to attribute a specific level of exposure to any of these three pathways.

4.2 Environmental Lead Exposure

A variety of studies have attempted to identify and quantify the relative contribution of environmental sources of lead. A model developed by Angle *et al.* (1984) predicts blood lead based on a linear regression model incorporating exposure from various sources. It was fitted and validated using a database of 1,074 blood lead samples collected from 831 children aged 1 to 18 years in different areas of Omaha, Nebraska, including 180 from the vicinity of a small battery plant. The model assumes that air, soil and house dust all contribute to lead exposure.

In 1975, Galke *et al.* reported on a study conducted on 187 children aged 0 to 5 years from 164 families in Charleston, South Carolina. Lead burdens were evaluated in relation to lead exposure from soil, automobile traffic and paint. Soil lead concentrations ranged up to 7900 mg/kg, with a median of 585 mg/kg. BPbs ranged from 18 to 77 µg/dl.

children tested had BPbs over 10 $\mu\text{g}/\text{dl}$. A multivariate linear regression model identified a variety of factors as significantly associated with elevated BPb, including several socioeconomic variables (race, income, level of household education) and behaviors (staying at home during play hours, carrying or mouthing a toy, having a smoker in the household). Location and duration of residence were also significant. The strongest association with being in the upper percentile of the BPb distribution was carrying or mouthing a toy. However, similar to the Jasper County study, only 39 percent of the BPb variability could be accounted for by the variables examined. These findings indicate that most of the observed lead accumulation, even in a high-risk area, is associated with unidentified environmental or biological factors.

Norgueras *et al.* (1995) conducted a case control study to identify factors associated with risk of elevated BPbs in children living in the vicinity of the Bunker Hill Superfund site. The site, located in Silver Valley, Idaho, was a lead mining and smelting facility. Declining BPbs have been observed based on annual screening conducted since 1974, with 1992 BPbs in the 8 $\mu\text{g}/\text{dl}$ range. Although air (with lead concentrations of 30 $\mu\text{g}/\text{m}^3$ observed) was considered the primary route of exposure prior to closure of the facility in 1981, soil/dust lead was of principal concern at the time of the study in 1995. Soil lead concentrations from backyards ranged from 53 to 20,700 mg/kg .

Yard soil remediation was found to have a protective effect, indicating that soil was a significant environmental source of lead. Having pets going in and out of the house was shown to be the most significant risk factor. Other variables significantly ($p < 0.05$) associated with BPb were furniture painting/staining, smoking inside the house and household income.

Soils from the Bunker Hill site are being used in ongoing studies to evaluate the gastrointestinal absorption of lead from soil in adults. Preliminary results indicate that fasted adults averaged an absorption of 26 percent (Maddaloni *et al.*, 1996), which is in the range previously reported for fasted subjects (as high as 60 percent; ATSDR, 1993). However, nonfasting subjects may have absorption as low as 3 percent. Additional studies are planned as part of this investigation in non-fasted subjects (Lolacono, 1996). Given the demonstrated bioavailability of lead from the soil at the Bunker Hill site may account for the fact that yard soil is an apparent significant source of environmental lead in this setting. Absorption in children is likely to be higher than that demonstrated for adults.

USEPA (1996b) recently published the results of a large-scale study of lead exposure in children from three cities (Boston, Baltimore and Cincinnati). The overall hypothesis of the study, known as the Urban Soil Lead Abatement Demonstration Project, was that a reduction in residential soil accessible to children would decrease BPbs. Intervention consisted of one or more actions, including soil abatement, interior and exterior dust abatement, and interior and exterior paint stabilization. The results were somewhat

variable. The Boston data suggested that BPb is reduced 2.2 to 2.7 $\mu\text{g}/\text{dl}$ in response to a soil lead decrease of 2,060 mg/kg . The Cincinnati study, however, found no significant impact of soil or dust abatement on BPb. Similarly, the Baltimore group concluded that soil abatement had no direct effect on BPbs. The overall project conclusions were that soil abatement can result in a reduction in exposure under certain conditions when soil is a significant source of lead in the child's environment (e.g., in the absence of lead-based paint). The results do not indicate that soil abatement is necessarily effective in reducing overall lead exposure, as evidenced by blood lead levels.

A study designed to evaluate the degree of association between soil lead and BPb near a former lead smelter in Granite City, Illinois was conducted by Kimbrough et al. (1994, 1995). The study included soil lead and BPb measurements. Kimbrough conducted surveys on 355 families having children under 6 years of age located in proximity to the smelter, and collected BPb measurements from 490 children in these families. The surveys included information on many potentially confounding factors related to BPb levels, including :

- Parent occupations
- Parent income
- Parent education
- History of smoking in the household
- Amount of time children play indoors and outdoors
- Location of child outdoor play areas
- Number of weekly baths by children
- Presence of air conditioning in the home
- Recent repair work or renovations on the home
- Whether the family rented or owned their house
- Condition of paint inside and outside the home
- Age of the home

Most of the homes were built between 1900 and 1960 and used lead-based paint. Many of the parents had a high school or lower level of education and a low income. The

unemployment rate in the area was about 18%. Of the 490 children tested, 16% had BPbs greater than 10 $\mu\text{g}/\text{dl}$; only 1% had BPbs above 25 $\mu\text{g}/\text{dl}$.

Lead content was measured in outdoor soil near the home, outdoor dust, indoor and outdoor paint, and tap water. Kimbrough et al conducted stepwise and multiple regression analyses on the variables to assess which factors accounted for the majority of the variability in measured BPb, as well as a correlation analysis to evaluate relationship among variables. BPbs were to be correlated with over a dozen variables, most of which were also significantly correlated with each other. However, similar to what has been found in other studies, only 37% of the variance in BPb could be accounted for by the variables assessed in the study. Soil lead accounted for at most of 3% of the variance, with paint condition and quantity of lead paint accounting for 11%. This study indicates that the condition of lead-based paint accounts for about four times as much exposure as does soil lead.

As stated by the authors, most of the significant variables, such as parental education and income, lead in paint, soil and house dust, child behavior, and history of smoking, were inter-correlated. Because of this, small differences of a few percentage points, such as found for the effect of lead in soil, are not of any apparent clinical significance.

Overall, the literature indicates that the extent of exposure related to soil lead (and, therefore, the potential for any associated soil abatement to reduce exposure) depends on the setting. Areas contaminated with mine waste seem to contain some bioavailable lead. However, no study has identified a single medium or variable that accounts for a majority of BPb impact. Taken together, these findings indicate that predictions of exposure from specific media cannot be generalized. Site-specific blood lead data indicate the level of recent exposure from all sources, most of which are likely unidentified. The proportion of exposure attributable to soil is likely to be low.

5 TOXICITY ASSESSMENT

As discussed in Section 3, blood lead (BPb) is the standard mechanism of assessing the potential hazards associated with lead exposure. While the hazard associated with a given BPb is not quantified in terms of a probability of adverse health effects, thresholds associated with hazard are widely used. The BPb threshold has been repeatedly lowered in recent years as the health impacts associated with lead exposure have become better characterized. In 1978, the Centers for Disease Control (CDC) defined an elevated blood lead level in children as 30 µg/dl or greater. A concentration of 25 µg/dl was established in 1985 (CDC, 1985). In October 1991, the threshold was reduced to 10 µg/dl based on evidence of permanent neurobehavioral damage, specifically IQ loss, in exposed children (Gaventa *et al.*, 1992; Rich, 1992) at levels as low as 10 µg/dl (Phillips *et al.*, 1995).

The 10 µg/dl threshold for children is still in effect. Minimizing the number of children with higher BPbs (to no more than 5% of the exposed population) served as the basis for a CERCLA screening level of 400 mg/kg in soils (USEPA, 1994). The guidance for dealing with lead sources in a residential setting (lead-based paint, contaminated dust and contaminated soil; USEPA, 1994b) is based on the same goal.

In the absence of a site-specific value, Florida (FDEP, 1995) uses a residential cleanup goal of 500 mg/kg; this goal is roughly based on USEPA guidance and is not based on specific toxicity calculations, as are cleanup goals for all other constituents (Roberts, 1996). The goal is not a standard or rule, but a guidance value in cases where the responsible party chooses not to perform a site-specific evaluation (FDEP, 1996).

6 RISK CHARACTERIZATION

The baseline hazard associated with the lead in ash at the site can be evaluated through addressing the following questions:

- Is there an elevated rate of high BPbs in children frequenting the site (above 10 µg/dl)?
- Is there a potential for BPbs to become elevated in children through exposure in the future in the absence of remedial action?

Current hazard is reflected in the blood lead database collected by the Duval County Public Health Unit of the Florida Department of Health and Rehabilitative Services (HRS) in 1995. Of the 130 kindergarten and pre-kindergarten children tested, six had BPbs equal to or greater than 10 µg/dl. The data on these samples are summarized below.

Date of Collection	Child's Date of Birth	Age at Time of Sample Collection	Bpb (µg/dl)
5/24/95	12/10/88	77 months	11
5/24/95	8/8/90	57 months	11
5/24/95	11/26/89	66 months	11
5/30/95	1/23/89	76 months	10
6/05/95	9/2/89	69 months	15
6/05/95	9/16/93	20 months	12

Because of confidentiality requirements, the HRS could not release the children's addresses. There is therefore no mechanism of determining which of the children tested lived in areas of the site overlying ash. However, the children were described as all being from the Brown's Dump neighborhood. It can therefore be assumed that they are overall representative of the population that is at potential risk from ash exposure.

It is also not possible to determine what proportion of overall lead exposure may have come from site soil. As described in Section 4, there are many environmental sources of lead, and an association between soil and blood lead cannot always be confirmed. The 4.6 percent rate (6 of 130) of elevated BPbs (defined as 10 µg/dl or above) in the site population is lower than the rate for inner city Jacksonville overall (8.9 percent). This confirms that, as in other cities, general environmental lead sources exist in Jacksonville. When compared with city-wide lead exposure, the data indicate that excess lead exposure at the Brown's Dump site is not occurring under current conditions. This rate of 4.6% is less than the target percentage of 5% used for screening CERCLA sites by USEPA (1994d).

The absence of significant exposure at the site is due to either:

- Absence of contact with lead-contaminated material (ash)
- Low bioavailability of lead in the ash

Because ash is present at the surface on both the school and residential properties, it is difficult to support the lack of direct contact assumption. Rather, the form of lead in the ash is probably low in bioavailability. This conclusion is consistent with findings in the literature, described in Section 4, which report highly variable relationships between soil lead and BPb. Lead in soil is not necessarily a principal or even significant source of overall lead exposure.

Surprisingly, there is not a large body of literature on lead bioavailability from different sources (Graziano, 1996), and there is apparently no body of literature on gastrointestinal lead absorption from municipal solid waste (MSW) incinerator ash (Graziano, 1996; Roberts, 1996). Both solubility and speciation are important factors affecting lead bioavailability (Maddaloni, 1996; ATSDR, 1993). MSW incinerator ash has different physico-chemical properties from soil that may substantially affect the extent to which associated contaminants can be absorbed from the gastrointestinal tract. Differences in soil properties are known to influence bioavailability (USEPA, 1995).

One measure of bioavailability is leachability. Studies on MSW ash and leachate concentrations suggest that leachability is low. USEPA has reported lead concentrations in MSW ash ranging from approximately 1,100 to 22,400 mg/kg, with most samples in the 1000 to 2000 mg/kg range (NUS, 1990). These levels are consistent with the concentrations found at the Brown's Dump site. Corresponding ash leachate concentrations in the USEPA study ranged from not detected (most cases) to 54 µg/l. These results indicate low leachability (i.e., less than 0.5%). At Brown's Dump, absence of shallow groundwater lead impacts (EMCON, 1995b) is further indication of low leachability. Material that does not leach readily may also be poorly absorbed in the gastrointestinal tract because material usually needs to be soluble in water to be absorbed.

There is limited information on inhalation bioavailability from MSW ash. A study was performed on MSW incinerator workers exposed intermittently to air lead concentrations as high as $2,500 \mu\text{g}/\text{m}^3$ during specific activities (Malkin et al., 1992). BPbs averaged $11 \mu\text{g}/\text{dl}$, versus $7.4 \mu\text{g}/\text{dl}$ in a control group. Inconsistent or lack of use of respiratory protection and smoking were significant predictors of BPb. This suggests that there is some bioavailability via inhalation, although BPb elevations were described by the authors as "mild." Inconsistent exposure may account for the small increases observed.

The extent of any future lead exposure from ash is difficult to assess. Increased exposure in the future could theoretically occur if lead land use patterns or behaviors changed markedly, increasing the potential for incidental ingestion or inhalation of ash, or resulting in additional exposure of sensitive individuals. However, this potential is low for the following reasons:

- Contact with ash is probably already high due to the surficial presence of ash throughout the neighborhood. It is unlikely that future activities would result in significantly higher potential for contact. Furthermore, as discussed above, the likely low bioavailability suggests that additional contact would pose little or no additional hazard.
- The neighborhood has remained stable and relatively unchanged for decades. Dramatically altered land use is not predicted.
- A high-risk receptor population (residences and a school) is already present. There is no potential for a more sensitive receptor population to occupy the site.

Overall, based on results of BPb measurements from sensitive child receptors in the neighborhood, there is apparently no elevated baseline excess human health hazard associated with lead in the ash.

7 CONCLUSIONS AND RECOMMENDATIONS

The blood lead data for site area children indicate BPbs are generally in the range or below levels reported for the City of Jacksonville overall. Studies in the literature suggest that this may be due to sources of environmental lead other than soil being more significant. It is also likely that lead in ash has lower bioavailability than in soil. Overall, excess lead exposure and hazard due to residing in the Brown's Dump area is not apparent.

However, lead concentrations in site soil (ash) are above the EPA screening level of 400 mg/kg. Despite the absence of identified current impacts and the low likelihood of future impacts, there remains the potential for lead exposure through the pathways described in Section 4. For these reasons, a variety of measures have been instituted and are ongoing. These should be viewed as precautionary in nature and not as evidence that there is a public health threat. They are based on site conditions and the potential exposure pathways identified in the literature.

Interim Remedial Measures (IRM) previously implemented for the site (EMCON, 1995c, 1996) were:

- Installation and maintenance of a 6-foot chain link fence with rolling gates to restrict access to school property (other than the playground).
- Placement of soil and grass cover over the playground area and basketball courts of the school, with subsequent maintenance by school personnel.
- Placement of soil cover and seeding over the egress point from the western boundary of school property.
- Restriction of access to the school courtyards after school hours.
- Installation of a temporary fence in the Bessie Circle cul-de-sac to prohibit pedestrian traffic through the City right-of-way.

In addition, shortly after the State Medicaid Program mandated BPb testing for Medicaid recipients age 6 to 72 months in 1993, the Duval County Public Health Unit (DCPHU) became aware that there was a lead problem, especially in the Jacksonville inner-city area. When the CDC announced the availability of competitive grant funds

for the control of childhood lead poisoning, the DCPHU made application and received a 3-year grant award. In the July 1995, grant activities began, which include intensive clinic and field testing of children and extensive environmental assessments at housing locations where poisoned children are found to reside. The Brown's Dump site is included in this targeted area. The environmental settings of the six children from the site area who showed elevated lead are in the process of being evaluated. Grant activities also include educating parents and the community regarding the hazard of lead poisoning and precautionary measures for avoiding or minimizing exposure to lead.

Because of continued concern regarding the potential for a lead poisoning problem at the Brown's Dump site, the DCPHU is currently engaged in additional door-to-door screening, including two large apartment complexes and a daycare center located in the vicinity of the site. Additional recruitment efforts for participants is underway, including evening recruiting to maximize the number of people contacted.

Proposed IRMs are:

- Design and installation of a new cover for the staff parking area in the front of the school.
- Continued verification that the access controls on the JEA property remain in place.
- Continuation of the ongoing public education program, including:
 - Dissemination of information ensuring that residents and school employees are aware of the situation and the potential for lead exposure. This should include a description of ash material so that it can be readily identified.
 - Formal recommendations to local residents, especially parents, to:
 - Maintain appropriate cover over areas on their properties where surficial ash is apparent. Grass, chips and gravel are acceptable cover materials.
 - Discourage their children from taking food/drink or toys that they may mouthe outside.
 - Ensure that children wash properly after coming inside, especially before meals.
 - Minimize indoor/outdoor movement of pets, or wash them down after contact with soil before allowing them indoors.

- Minimize or eliminate indoor smoking.
- Use clean topsoil for home vegetable gardens.
- Discourage access by pets or children to Moncrief Creek.
- Remove shoes upon entering the house.
- Continuation of the ongoing BPb testing program including:
 - BPb testing for all concerned residents.
 - Lead content testing of home-grown produce.
 - Guidance as to factors that should prompt such testing.
 - Guidance as to the interpretation of any lead testing results.
- Permanent remediation of the “hot spot” of soil lead identified north of Moncrief Creek (78,800 mg/kg) and confirmatory sampling to verify that remaining material is in the range of site-wide soil lead concentrations (e.g., below 5,000 mg/kg).

Given the absence of identified excess human health hazard under baseline conditions, more intrusive corrective action, such as extensive soil removal, is not required.

LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

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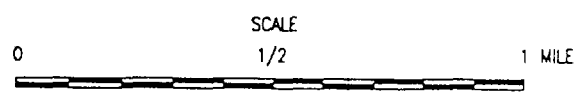
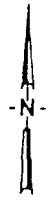
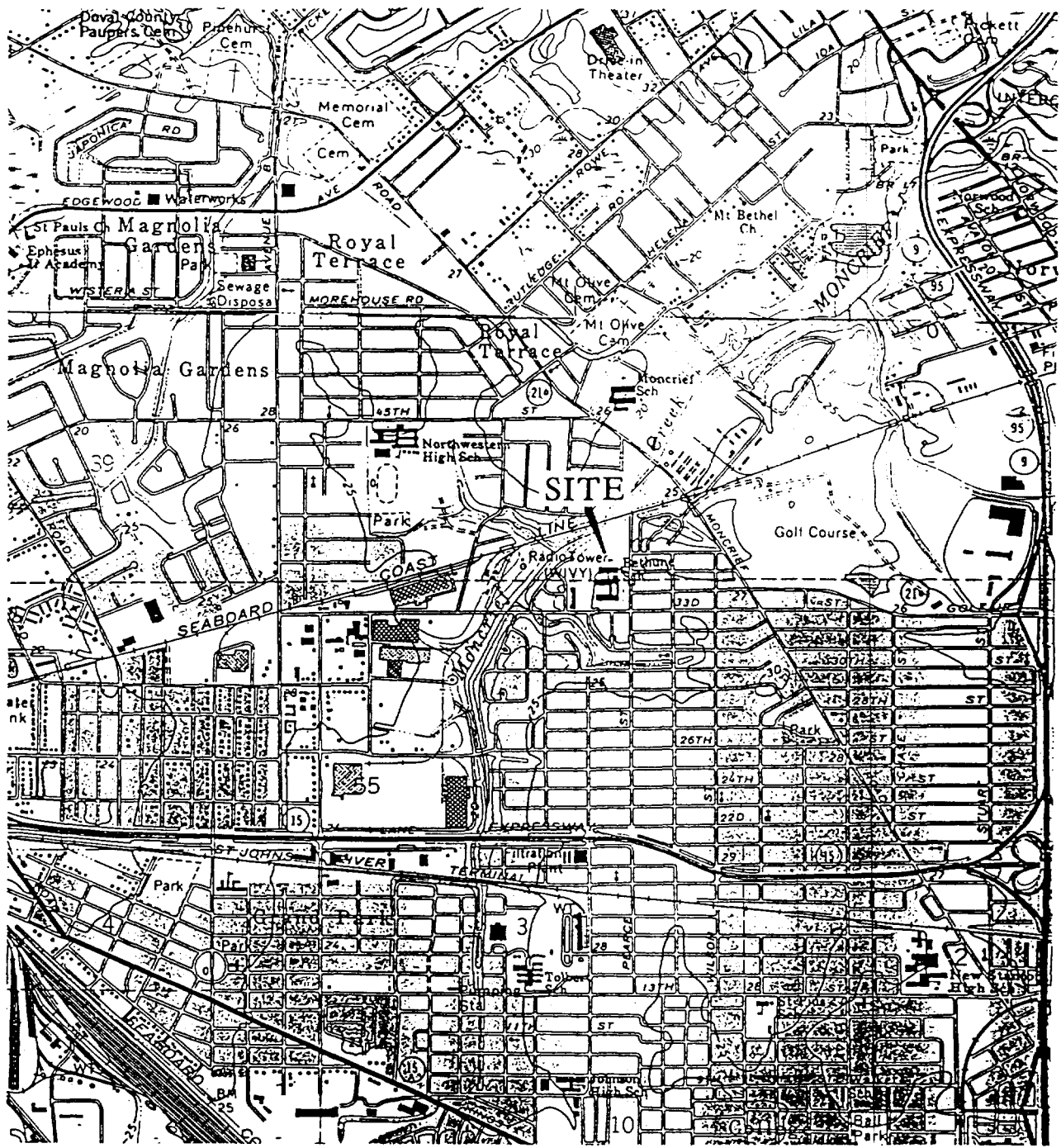
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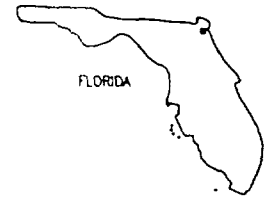
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FIGURES



CONTOUR INTERVAL 5 FEET



BASE MAP FROM USGS 7.5' QUADRANGLE MAP: JACKSONVILLE, FLORIDA, PHOTOREVISED 1982

QUADRANGLE LOCATION



emcon

BROWN'S DUMP

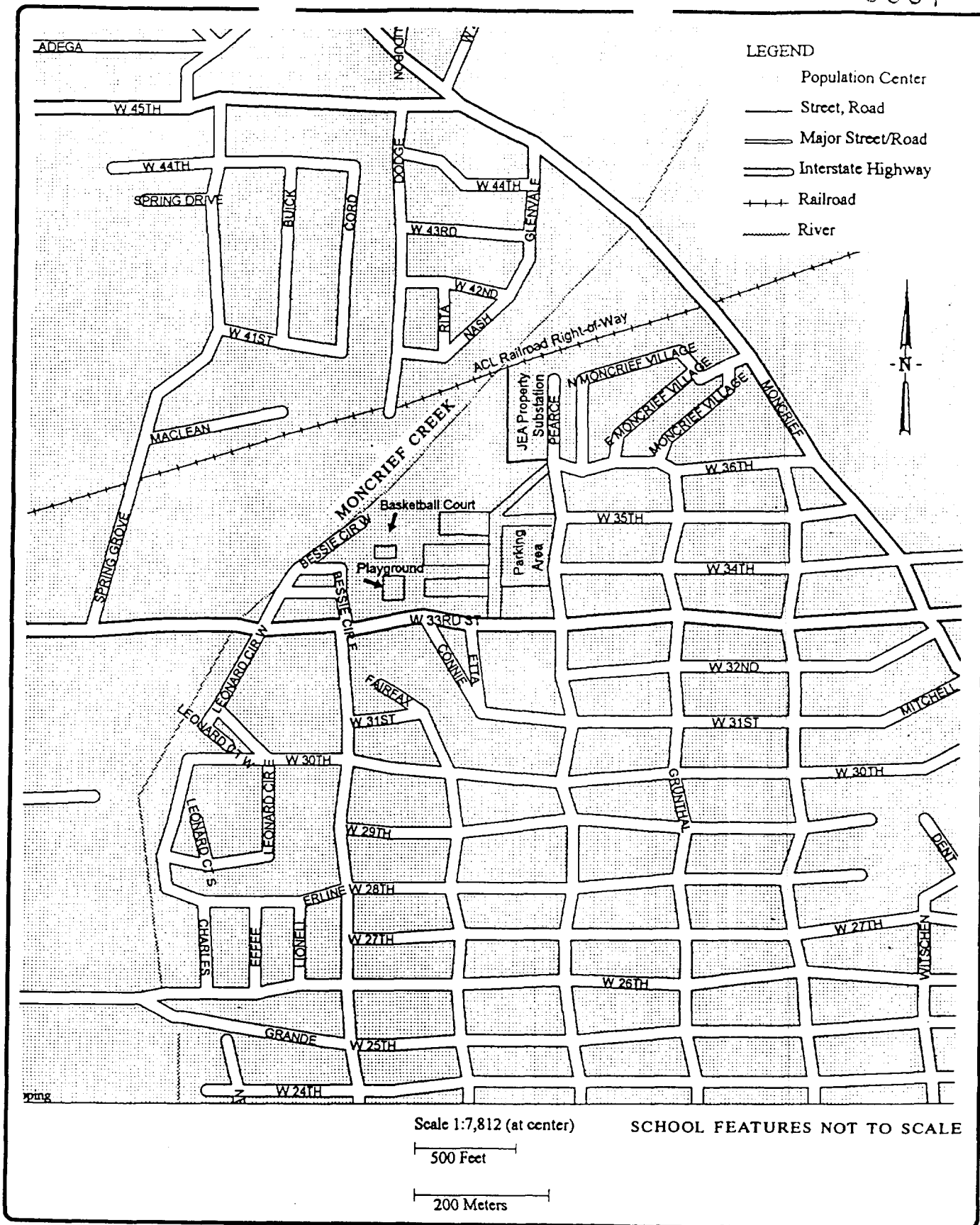
JACKSONVILLE, FLORIDA

SITE LOCATION

FIGURE

1

PROJECT NO.
71286.001.090



EMCON

BROWN'S DUMP

JACKSONVILLE, FLORIDA

SITE LOCATION

FIGURE

2

PROJECT NO.

71286.001.090